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Original article

Participatory evaluation of rice cultivars during diversity fairs in Cuba

Evaluación participativa de cultivares de arroz en ferias de diversidad en Cuba

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ABSTRACT: Participatory Variety Selection (PVS) has established itself as an effective tool for the plant breeding in agroecological contexts. This study was conducted at two diversity fairs held in the Rafael Ferro Morales Credit and Service Cooperative (Pinar del Río) and the CCS José Martí (Matanzas), where 20 rice cultivars were evaluated with the aim of identifying those with the greatest acceptance and the agronomic criteria of highest importance from the perspective of participants, defined by producers, technicians, and other local actors in the participatory selection process. The recommendations from the Technical Instruction for Rice Cultivation were followed, adapted by local producers according to their agroecological practices. The data were processed with descriptive statistics using Microsoft Excel 2019, and the most valued selection criteria by the participants were analyzed. Lines 8908, 8909, and 8910, along with the cultivars Ginés LP-18, Isra LP-24, Alayn LP-27, and Roana LP-15, stand out for agronomic traits such as number of panicles, plant architecture, pest resistance, and vegetative cycle. The active participation of women strengthened the inclusive approach of the process. The results show that Participatory Variety Selection allows for the identification of cultivars adapted to local conditions, promotes resilience to climate change, and contributes to food security.

Key words: *Oryza sativa* L., participatory selection, plant breeding.

RESUMEN: La Selección Varietal Participativa se ha consolidado como una herramienta eficaz para el mejoramiento genético de cultivos en contextos agroecológicos. Este estudio se desarrolló en dos ferias de diversidad realizadas en las Cooperativas de Crédito y Servicio Rafael Ferro Morales (Pinar del Río) y José Martí (Matanzas), donde se evaluaron 20 cultivares de arroz con el objetivo de identificar los de mayor aceptación y los criterios agronómicos de mayor consideración desde la perspectiva de los participantes, definidos por productores, técnicos y otros actores locales en la selección participativa. Se siguieron las recomendaciones del Instructivo Técnico del Cultivo del Arroz, adaptadas por los productores según sus prácticas agroecológicas. Los datos se procesaron con estadística descriptiva usando Microsoft Excel 2019 y se analizaron los criterios de selección más valorados por los participantes. Las líneas 8908, 8909 y 8910, junto a los cultivares Ginés LP-18, Isra LP-24, Alayn LP-27 y Roana LP-15, destacan por caracteres agronómicos como número de panículas, porte, resistencia a plagas y ciclo vegetativo. La participación activa de mujeres fortaleció el enfoque inclusivo del proceso. Los resultados evidencian que la Selección Varietal Participativa permite identificar cultivares adaptadas a condiciones locales, promueve la resiliencia frente al cambio climático y contribuye a la seguridad alimentaria.

Palabras clave: mejoramiento genético, *Oryza sativa* L., selección participativa.

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INTRODUCTION

Participatory Varietal Selection (PVS) has been consolidated as a key strategy in crop genetic improvement, especially in agricultural contexts where diversity and local adaptation are essential. Globally, this approach has proven effective in incorporating farmers' preferences into the identification of more resilient, productive, and culturally accepted varieties, thereby strengthening food sovereignty and agroecological sustainability. In countries such as India, the Philippines, and Nepal, PVS has been used to improve the adoption of rice cultivars adapted to specific soil, climate, and cultural practices, with positive results in yield and community acceptance (1).

In Latin America, Participatory Varietal Selection has been successfully implemented in countries such as Colombia, Ecuador, Panama, and Argentina, as part of the strategies of the Latin American Fund for Irrigated Rice (FLAR) and its regional partners. These experiences have shown that PVS not only accelerates the adoption of varieties adapted to local conditions but also strengthens the link between researchers, producers, and technicians through field co-evaluation processes. In Colombia, for example, more than one hundred elite rice lines have been developed through participatory methodologies and genomic analyses, prioritizing traits such as resistance to abiotic stress, milling quality, and yield in contrasting environments (2). The articulation between public and private institutions has been key to expanding the available genetic diversity and improving crop sustainability in the region (3).

In Africa, countries such as Burkina Faso and Madagascar have used diversity fairs as platforms to validate local cultivars and promote knowledge exchange between farmers and researchers, thereby strengthening resilience to climate change (4).

In Cuba, PVS has been driven mainly by the Local Agricultural Innovation Program (PIAL), which promotes the active participation of producers in the evaluation and selection of cultivars. Diversity fairs constitute dynamic spaces where knowledge is exchanged, technologies are validated, and cultivars are selected based on agronomic and sociocultural criteria (5).

In this context, two diversity fairs were held at the Rafael Ferro Morales Credit and Service Cooperative (CCS, according its acronym in Spanish) in Consolación del Sur, Pinar del Río, and the José Martí CCS in Amarillas, Calimete, Matanzas. Twenty rice cultivars were presented with the objective of identifying those with the greatest acceptance and the agronomic criteria most valued from the perspective of participants, defined by producers, technicians, and other local actors in the participatory selection process.

MATERIALS AND METHODS

The study was conducted in two productive units in western Cuba: the Rafael Ferro Morales Credit and Service Cooperative (CCS) in Consolación del Sur (Pinar del Río), on Fluvisol soil (6), and the José Martí CCS in Amarillas, Calimete municipality (Matanzas), on Gleysol soil (6). At both sites, rice cultivar gardens were established with 20 genotypes previously selected at the National Institute of Agricultural Sciences (Table 1).

The plots were prepared to ensure uniformity in edaphoclimatic conditions, minimizing the influence of external factors on the phenotypic performance of the cultivars. The recommendations of the Technical Guide for Rice Cultivation (7) were followed, adapted by local producers according to their agroecological practices. Transplanting was carried out with seedlings 25 to 30 days old, placed in muddy soil at a spacing of 15 cm, with two seedlings per site.

Each cultivar was sown in 1 m² plots, separated by 50 cm to avoid competition among cultivars. During the diversity fairs, participants, including producers, technicians, and decision-makers (Table 2), carried out participatory selection through direct observation of the cultivars and the use of structured surveys (Figure 1).

Data were processed using descriptive statistics in Microsoft Excel 2019, and the selection criteria most valued by participants were analyzed.

RESULTS AND DISCUSSION

A total of 87 people participated in both diversity fairs, with 20 % female representation among producers, evidencing progress in gender inclusion within agricultural innovation processes. The implementation of participatory methodologies in plant breeding has made visible the role of women as evaluators and selectors of cultivars, strengthening their leadership in local agricultural innovation.

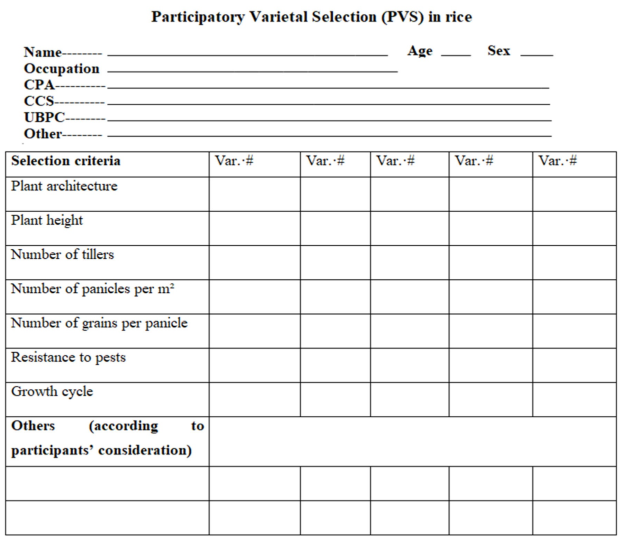
Studies on diversity fairs in Cuba have documented a growing female participation in cultivar selection, reflecting a cultural shift toward equity in agricultural decision-making.

Table 1. Rice cultivars displayed at the Diversity Fairs for participatory selection in the Rafael Ferro Morales and José Martí CCSs.

No.	Cultivars	No.	Cultivars	No.	Cultivars
1	INCA LP-2	**8**	Nenita LP-25	**15**	Magda LP-27
2	INCA LP-4	**9**	Isra LP-24	**16**	Selection in Magda LP-27
3	INCA LP-5	**10**	8906	**17**	Eduard LP-21
4	INCA LP-7	**11**	8907	**18**	Selection in Eduard LP-21
5	Anays LP-14	**12**	8908	**19**	Sergimar
6	Roana LP-15	**13**	8909	**20**	Alayn LP-26
7	Ginés LP-18	**14**	8910		

Table 2. Number of participants by groups in the participatory selection of rice cultivars at the CCS Rafael Ferro Morales and José Martí.

	CCS Rafael Ferro Morales			CCS José Martí		
Groups	**Number of participants**	**Men**	**Women**	**Number of participants**	**Men**	**Women**
Producers	29	23	6	19	16	3
Technicians	12	6	6	12	10	2
Decision-makers	7	4	3	8	7	1
Total	48	33	15	39	33	6



Participatory Varietal Selection (PVS) in rice

Name-------- ______ **Age** ____ **Sex** ____
Occupation ______
CPA---------- ______
CCS---------- ______
UBPC-------- ______
Other-------- ______

Selection criteria	Var.·#	Var.·#	Var.·#	Var.·#	Var.·#
Plant architecture					
Plant height					
Number of tillers					
Number of panicles per m²					
Number of grains per panicle					
Resistance to pests					
Growth cycle					
Others (according to participants' consideration)					

Figure 1. Survey applied during the participatory selection of rice cultivars.

For example, the Local Agricultural Innovation Project (PIAL) has actively promoted gender inclusion, achieving that 30% of those trained in agricultural topics were women, and significantly increasing female leadership in rural communities (8). Furthermore, the Gender Strategy of the Cuban Agricultural System 2021-2025 establishes rural women's empowerment as a political priority, with strategic lines focused on leadership, innovation, and active participation in productive processes (9).

In Latin America, it is recognized that rural women face structural barriers, but advances have also been recorded in their participation in agri-food chains, particularly in spaces of innovation and community leadership (10).

During the diversity fairs, a participatory selection exercise was applied to 20 rice cultivars. Figures 2 and 3 show the cultivars preferred by participants in each productive unit:

CCS Rafael Ferro Morales: Line 8909 (88.6 %), Isra LP-24 (40 %), Alayn LP-27 (34.3b %), Roana LP-15 (28.6b %), and Line 8906.

CCS José Martí: Commercial cultivar Ginés LP-18 (82.05 %), Line 8910 (76.9 %), Line 8909 (61.5 %), Line 8908 (41 %), and Isra LP-24 (40 %).

Line 8909 stood out for its almost unanimous preference in Pinar del Río, while in Matanzas the commercial cultivar Ginés LP-18 was the most selected. However, it is important to highlight that in both locations, the selectors' preferences included some lines (8906, 8907, 8908, 8909, 8910), evidencing notable interest from producers and other actors involved in the selection exercise towards the proposed new lines, which have achieved preference percentages similar to or even higher than the commercial cultivars currently in production. This result is an encouraging indicator of the program's impact, as it demonstrates that the proposed new materials generate acceptance because they are competitive.

The commercial cultivar Ginés LP-18 is a mutant of J-104, obtained from in vitro culture of proton-irradiated seeds. It has a short cycle and is characterized by excellent agricultural yield, tolerance to salinity and drought. Very positive results from its introduction were obtained by small-scale producers, as well as seed producers and large-scale planting in the Cuba-Vietnam Joint Program, where yields exceeding seven tons per hectare have been achieved, similar to those attained with the Vietnamese hybrid cultivars used within the framework of the aforementioned program (11).

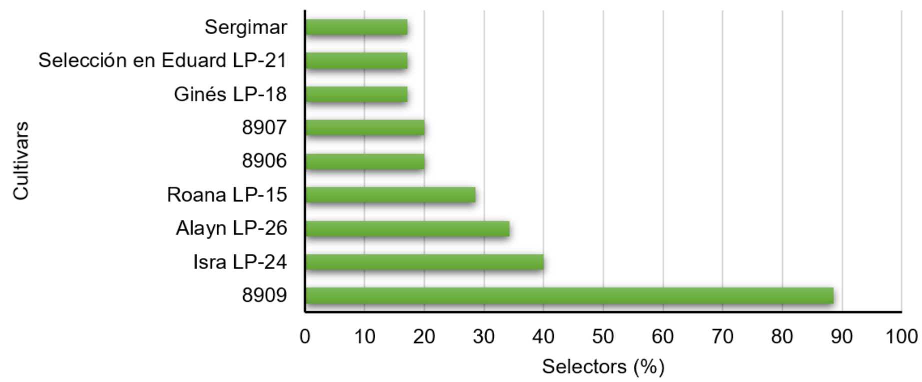


Figure 2. Rice cultivars selected at the CCS Rafael Ferro Morales by participants during the participatory exercise.

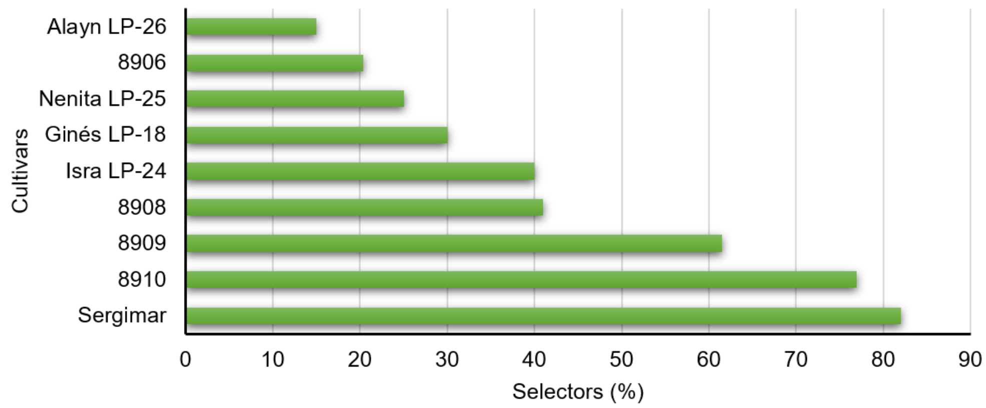


Figure 3. Rice cultivars selected at the CCS José Martí by participants during the participatory exercise.

There is agreement in the selection of cultivar Isra LP-24 in both production units, at 40 %, which could suggest adaptability and multi-site stability. This cultivar, obtained by hybridization, was evaluated in superior yield trials and subsequently validated in areas of the cooperative and peasant sector in the municipalities of Los Palacios and La Palma, where it showed good performance in terms of morphoagronomic traits, agricultural and industrial yields, as well as field tolerance to the main pests affecting the crop (12). Due to its stability in different environments, it becomes an excellent option with possibilities for widespread use.

Alayn LP-26, derived from in vitro anther culture and with adaptability to low water supply, aligns with climate resilience criteria, while Roana LP-15, with a medium cycle, has been validated in peasant systems with yields exceeding 7.5 t ha^{-1} (13).

The differentiated selection of cultivars in different locations responds to a complex interaction between climatic, edaphic, agroecological, cultural, and management factors. Climate directly influences the phenological and productive behavior of cultivars, and edaphic characteristics also condition the expression of genotypes. On the other hand, cultivation practices vary between sites according to access to inputs, mechanization, and technical knowledge, so local management influences producers' perception of the usefulness of certain traits, which modifies their varietal preferences. Also, these may be influenced by the socioeconomic context, gender, and the final use of the crop (14).

Participatory selection made it possible to identify cultivars with high social and agronomic acceptance, reinforcing the value of this methodology as a decentralized plant breeding tool. Studies in Nepal, Indonesia, the Philippines, and Ethiopia report similar experiences and suggest that this methodology facilitates the adoption of locally adapted cultivars (15-18). These findings reinforce the role of PVS as an effective strategy to link peasant knowledge with technological innovation processes in diverse contexts.

During the diversity fairs at the CCS Rafael Ferro Morales and CCS José Martí, participants identified key agronomic criteria for the selection of rice cultivars, as shown in Figures 4 and 5.

The most highly valued traits were the number of panicles per square meter (80-85 %), plant architecture (75-80 %), pest resistance (75 %), crop cycle (70-75 %), while the number of tillers and plant height were also considered relevant (50-65 %).

The number of panicles per unit area is one of the most decisive components of rice yield and is directly influenced by planting density, the number of fertile tillers, and agronomic management. Panicle density is known to be the most management-sensitive factor and the most critical for achieving high yields in rice cultivation (19).

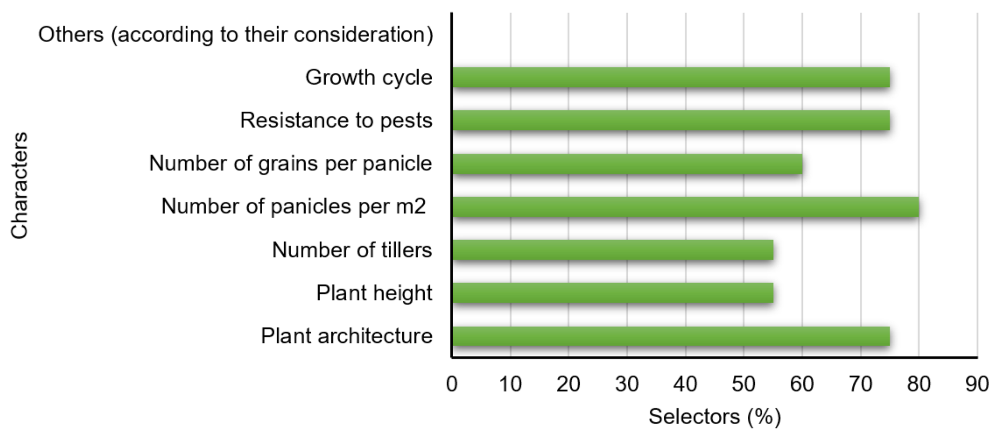


Figure 4. Selection criteria of cultivars at the CCS Rafael Ferro Morales, as chosen by participants during the participatory exercise.

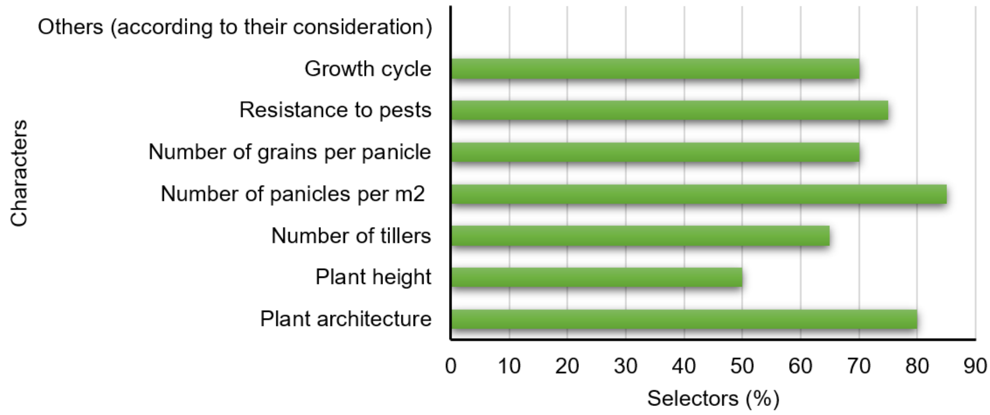


Figure 5. Selection criteria of cultivars at the CCS José Martí, as chosen by participants during the participatory exercise.

These results are consistent with recent studies that highlight the importance of yield components and adaptability as key factors in participatory selection. For example, in Nepal and Indonesia it has been demonstrated that farmers prioritize visible and functional traits that directly affect productivity and agronomic management (15,16).

The high valuation of plant architecture, crop cycle, and pest resistance also reflects a concern for crop manageability and the reduction of external inputs, aligning with agroecological and sustainability principles.

Plant architecture refers to the general structure of the plant, including height, leaf angle, and stem rigidity. It is a qualitative trait that influences photosynthetic efficiency, lodging resistance, and ease of harvest. Breeders focus on selecting erect plant types due to their advantages, which is confirmed in morpho-agronomic characterization studies of cultivars, where plant architecture is one of the most homogeneous and relevant traits for agronomic selection (20).

Rice pests cause enormous yield losses, and precise and timely studies of these are important to control them and prevent production reduction (21). Therefore, it is relevant that producers prioritize pest resistance in their choices.

The crop cycle refers to the time from germination to physiological maturity. While medium-cycle cultivars generally achieve higher yields than short-cycle ones, the latter have advantages that make them ideal under certain conditions. For example, they allow reduced water and fertilizer consumption, which is essential in contexts of water scarcity and environmental pressure. By shortening exposure time to adverse conditions, these cultivars offer greater resilience to extreme climatic events such as droughts or floods. In addition, they enable two or more harvests per year and are especially useful in crop rotation systems and in areas with limited planting windows (22). It would be interesting in similar studies to analyze in greater depth producers' preferences regarding short- and medium-cycle cultivars.

Furthermore, other authors emphasize that genotype×environment interaction can be exploited to select varieties specific to each agroecological zone, reinforcing the decentralized approach of participatory plant breeding (23). In this study, the convergence of criteria between both production units suggests a convergence in producers' preferences, which may facilitate the validation of cultivars across multiple contexts.

CONCLUSIONS

- The PVS (Participatory Varietal Selection) proved to be an effective tool for identifying rice cultivars with high productive potential and strong social acceptance under Cuban agroecological conditions. Diversity fairs facilitated direct interaction among producers, researchers, and decision-makers, strengthening the science-field link.
- Lines 8908, 8909, and 8910, along with the cultivars Ginés LP-18, Isra LP-24, Alayn LP-27, and Roana LP-15, stand out for agronomic traits such as number of panicles, plant architecture, pest resistance, and vegetative cycle.
- The PVS allowed the validation of cultivars adapted to local conditions, contributing to the genetic diversification of the crop and resilience to climate change. Furthermore, its value is reaffirmed as a strategy to strengthen food security and technological sovereignty in the Cuban agricultural sector.

BIBLIOGRAPHY

1. Díaz SH, Morejón R, Pérez N, Castro R. Selección Varietal Participativa (PVS): un enfoque de mejoramiento en arroz dirigido a la población meta. Cultivos Tropicales. 2025;46(2). Available from: https://ediciones.inca.edu.cu/index.php/ediciones/article/view/1871.
2. FLAR. Ciencia, alianzas y nuevas variedades de arroz para América Latina y el Caribe [Internet]. Fondo Latinoamericano para Arroz de Riego. 2025. Available from: https://flar.org/ciencia-alianzas-y-nuevas-variedades-de-arroz-para-america-latina-y-el-caribe/.
3. Hoyos N, Andrade R. Más de cien líneas élite de arroz para América Latina y el Caribe serán adoptadas, procedentes de los programas de mejoramiento del arroz (Alianza-FLAR) [Internet]. Alianza Bioversity y CIAT. CGIAR. 2023. Available from: https://alliancebioversityciat.org/es/alianza-en-cgiar.

4. Delgado H, Silva A, Guarín LA. Evaluación agronómica de líneas de arroz de sabana (*Oryza sativa* L.) obtenidas mediante mejoramiento poblacional por selección recurrente. Revista U.D.C.A Actualización & Divulgación Científica. 2021;24(2):e1707. DOI: http://doi.org/10.31910/rudca.v24.n2.2021.1707.
5. González D, Galbán M, Monteagudo JA, Sarduy D. Métodos participativos como vía para la difusión de tecnologías y cultivares de arroz. Agrotecnia. 2018;42(2):50-61. Available from: https://www.grupoagricoladecuba.gag.cu/media/Agrotecnia/pdf/42_2018_2/6.pdf.
6. Hernández A, Pérez J, Bosch D, Castro N. Clasificación de los suelos de Cuba 2015 [Internet]. Instituto Nacional de Ciencias Agrícolas, Cuba: EDICIONES INCA. 2015. 93 p. Available from: https://isbn.cloud/9789597023777/clasificacion-de-los-suelos-de-cuba-2015/.
7. MINAG. Instructivo Técnico Cultivo de Arroz. Instituto de Investigaciones del Arroz [Internet]. MINAG. 2014. 73 p. Available from: https://isbn.cloud/9789597210863/ instructivo-tecnico-cultivo-de-arroz/.
8. Benítez B, Crespo A, Casanova C, Méndez A, Hernández Y, Ortiz R, et al. Impactos de la estrategia de género en el sector agropecuario, a través del Proyecto de Innovación Agropecuaria Local (PIAL). Cultivos Tropicales. 2021;42(1). Available from: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0258-59362021000100004&lng=es&tlng=es.
9. MINAG. La Estrategia de Género del Sistema de la Agricultura 2021-2025 [Internet]. MINAG 2021. Available from: www.genero.onei.gob.cu/static/documents/informes/Estrategia%20de%20Genero%20de%20Sistema%20de%20la%20agricultura.pdf.
10. CEPAL. Participación de las mujeres en el sector agrícola y agroalimentario de América Latina y el Caribe [Internet]. CEPAL. 2021. Available from: www.cepal.org/sites/default/files/document/files/presentacion_agg_dag-cepal_cumbre_cafe_121121.pdf.
11. Suárez R. 2025. Variedad cubana de arroz confirma su alto potencial productivo. Periódico Granma. Available from: https://www.granma.cu/.
12. Díaz SH, Morejón R, Pérez, N. ISRA LP-24. Nuevo cultivar de arroz (*Oryza sativa* L.) de ciclo medio, obtenido por hibridaciones. Cultivos Tropicales. 2022;42(4 s1), e03. Available from: https://ediciones.inca.edu.cu/index.php/ediciones/article/view/1629.
13. Morejón R, Díaz SH. Respuesta de líneas promisorias de arroz en finca del municipio Los Palacios, Cuba. Cultivos Tropicales. 2025;46(3). Available from: https://ediciones.inca.edu.cu/index.php/ediciones/article/view/1877.
14. Weltzien E, Rattunde F, Sidibé M, Vom Brocke K, Diallo A, Haussmann B, *et al*. Long-term collaboration between farmers' organizations and plant breeding programmes: Sorghum and pearl millet in West Africa [Internet]. In Farmers and plant breeding. 2019. pp. 29-48. Available from: https://cgspace.cgiar.org/server/api/ core/bitstreams/7d03bb3e-c45c-4ebe-8e5e-db1586f61a69/content#page=52.
15. Gauchan D, Joshi KD, Subedi A. Participatory crop improvement and formal release of Jethobudho rice landrace in Nepal [Internet]. LI-BIRD. 2022. Available from: https://libird.org/wp-content/uploads/2022/04/Participatory_crop_improvement_and_formal_release_of_Jethobudho_rice_landrace_in_Nepal_1396.pdf.
16. Sari N, Hidayat T, Prasetyo B. Participatory Rice breeding in rainfed land to sustainable agriculture. Phyton. 2025;94(7). Available from: https://www.techscience.com/phyton/v94n7/63213.
17. Reyes MA, Santos RJ, De Guzman C. Enhancing rainfed lowland rice production: Insights from PVS in Central Luzon. Seybold Report. 2023;19(6). Available from: https://admin369.seyboldreport.org/file/V19I06A48_12607101-zEvOp3kw9P0SVGu.pdf.
18. Teshome A, Mekonnen Y, Abebe T. Participatory rice breeding in rainfed land to sustainable agriculture. Phyton. 2025;94(7). Available from: https://www.techscience.com/phyton/v94n7/63213.
19. Calero A, Pérez Y, Quintero E, González Y. Densidades de plantas adecuadas para incrementar el rendimiento agrícola del arroz. Centro Agrícola. 2021;48(1):28-36.
20. Pérez NJ, Díaz G, Rodríguez LM, Hernández T. Evaluación de cultivares de arroz (*Oryza sativa* L.) de Vietnam, para su introducción en Cuba. Revista Colombiana de Biotecnología. 2023;25(1). DOI: http://doi.org/10.15446/rev.colomb.biote.v25n1.107284.
21. Li S, Feng Z, Yang B, Li H, Liao F, Gao Y, et al. An intelligent monitoring system of diseases and pests on rice canopy. Frontiers in Plant Science. 2022 Aug 11:13:972286. DOI: http://doi.org/10.3389/fpls.2022.972286.
22. Diario del Agro. El Ciclo de Vida del Arroz: Un Viaje desde la Siembra hasta la Cosecha [Internet]. 2023. Available from: https://www.diariodelagro.cl/el-ciclo-de-vida-del-arroz-un-viaje-desde-la-siembra-hasta-la-cosecha/.
23. Justo SB, Mkamilo HG, Danga NO, Huseni R, Ally FS, Mwakapala RA, *et al.* Genotype and genotype x environment interaction effects on the rice grain yield performance in different agro-ecologies in Tanzania. Journal of Plant Breeding and Crop Science. 2024;16(2):36-45. DOI: http://doi.org/10.5897/JPBCS2024.1038.